

Request for Quote (RFQ)

for

NASA Goddard Space Flight Center (GSFC)  
Spacecraft Bus for Low Earth Orbit (LEO) Satellite Servicing Study

September 18, 2014

## **1.0 Introduction and Scope**

NASA is currently assessing the feasibility of servicing and repairing satellites in Low Earth Orbit (LEO) in order to extend their useful life. To this end, NASA envisions robotic activities for earth observing satellites in LEO that need fuel, repair, or instrument replacement. Extending the mission life of NASA and other government satellites would extend the data collection capability of the spacecraft that support national or agency missions.

In response to RFQ NNG14042814L issued by NASA to study the feasibility of using existing spacecraft buses for reaching the client spacecraft, three companies showed that they had available spacecraft buses, or other vehicle for similar purpose, that could meet the Satellite Servicing Capabilities Office's (SSCO) requirements, including a tight schedule. Two of the vendors proposed dedicated spacecraft buses that they owned; one proposed a vehicle owned by another agency of the U.S. Government. Each of the companies conducted a detailed study of the technical compatibility and interfaces between their spacecraft bus and the SSCO's Servicing Payload. These companies delivered their final feasibility study packages on 7/21/14, along with supporting documentation, including cost estimates. These studies validated that each of the three spacecraft buses were technically feasible, mature, and affordable for performing LEO satellite servicing.

In order to further its goal, NASA/GSFC is now seeking one or more companies to perform a 100-day concept and technology study that further matures a design for refueling a LEO satellite specified by NASA using an existing spacecraft bus with proven true 6 degrees of freedom (DOF) maneuvering capability to allow precision flight near a client. NASA/GSFC may award one or more firm-fixed price purchase orders valued at \$150K each.

NASA is considering servicing at least one national asset as soon as mid CY 2018. As a result, this study is limited to spacecraft buses or other flight vehicles for accessing LEO that currently exist and are currently available for a mid CY 2016 payload integration to support a second quarter 2018 launch on a U.S. launch vehicle. In addition, these buses must be capable of 6 DOF maneuverability.

During this study, selected contractor(s) shall develop the functional and performance requirements of its already available spacecraft bus that along with the NASA/GSFC SSCO robotic servicing payload can conduct refueling of Earth Science LEO satellites. Additional details of the products to be delivered for the study are provided in the attached Statement of Work (SOW), along with a list of the information GSFC will provide about the Servicing Payload and the potential client satellites. While the LEO servicing mission schedule cannot be specified completely at this time since no mission has been approved and NASA may or may not decide to move forward with future mission planning as a result of this study, the following is estimated on the basis of current knowledge of mission development life cycles and the status of potential client satellites:

<b>Milestones (Study Phase)</b>	<b>Due Date</b>
Study RFQ release	<<RFQ release date>>
Study proposals due	RFQ release + 12 Calendar Days
Study selection	Proposal Due Date + 5 business Days
Award of purchase order	Selection + 1 day

Delivery of NASA data package	Award + 1 business day
Face-to-Face Meeting 1	Award + 4 weeks
Face-to-Face Meeting 2	Award + 8 weeks
Final study report & associated products delivery	Award + 14 weeks

The following milestones are for planning purposes only:

<b>Milestones</b>	<b>Date</b>
Systems Requirements Review/Preliminary Design Review	July 2015 (TBC)
Critical Design Review	February 2016 (TBC)
Delivery of spacecraft bus	June 2016
System Integration Review	January 2017 (TBC)
Launch Readiness Review	February 2018 (TBC)
Launch Readiness Date	Second quarter 2018
Check-out and commissioning	Launch + 90 days (TBC)
Servicing campaign Start	Launch + 100 days (TBC)
End of operations	Launch + 1 year (TBC)

This opportunity is being issued to formally conduct studies to further refine a potential servicing mission concept and further refine the cost, schedule, and technical maturity of spacecraft buses for performing the mission. Only spacecraft buses are being examined by this RFQ; Servicing Payload hardware/components are not part of this RFQ. If NASA decides to conduct a satellite-servicing mission, funding will be available for the standard phases of a mission, and any contracts or agreements for spacecraft or other hardware would be determined through separate acquisition processes.

## **2.0 Mission Overview**

NASA is considering on-orbit refueling as a means of satellite life extension to enable continued data collection of earth science data. With a robotic servicer, based on the legacy of Hubble servicing and bolstered with technology developed by NASA's Satellite Servicing Capabilities Office (SSCO), on-orbit refueling is a feasible, logical recourse. However, near-term propellant exhaustion in several of the candidates for refueling dictates an ambitious schedule based on arriving prior to satellite decommissioning/de-orbit.

Getting a reliable on-orbit refueler to the launch pad by second quarter CY 2018 will be a challenge. Through these studies, NASA is maturing the idea of using existing hardware available today to meet mission requirements within programmatic constraints of cost and schedule.

More detailed information on the mission parameters of potential servicing candidates and the Servicing Payload will be provided to each contractor selected for a study. See the SOW for types of information that will be provided.

## **3.0 Description of Study Support**

The study requirements include meeting with the SSCO's Servicing Payload developers and the overall mission engineering team in order to: (1) refine and mature the interfaces between the

Servicing Payload and the spacecraft; (2) mature the flight system architecture and concept of operations; and (3) predict performance and quantify and mitigate risks. Each study shall include a detailed cost estimation for all mission phases and other information details defined in the SOW. The period of performance for the study is 100 days.

For this study, NASA will identify and provide information about existing on-orbit satellites as potential servicing opportunities, and provide information about a Government-provided servicing payload, including interfaces and characteristics such as mass and volume. The Government-provided servicing payload would be transported to LEO by the spacecraft bus and would include a rendezvous and proximity operations system, robotics, propellant transfer system, and tools.

The study contractor shall participate in at least two face-to-face technical interchange meetings (TIMs) with SSCO's civil servants and support contractors to discuss refinements of requirements for the spacecraft bus. Additional meetings to address questions of either NASA or the contractor may be conducted via teleconference.

Presentations for the TIMs, along with the final study report, shall be delivered with appropriate data rights that will allow SSCO's support contractor(s) to view and use the information to help in assessing the feasibility of a servicing mission.

#### **4.0 Study RFQ Response Instructions**

The respondent to this RFQ shall:

- a. Identify the spacecraft bus proposed to meet the requirement. Provide a technical summary/description of the proposed existing spacecraft bus including the following:
  - Mass of and mass carrying capability of the spacecraft
  - Power, communication and any thermal control the spacecraft can provide to potential payloads
  - Power efficiency of system
  - Ability to survive and operate in sun-synchronous LEO
  - Maneuvering capability
  - Ability of system to meet or simplify other mission requirements or challenges the respondent identifies
  - Compatibility with U.S. launch vehicles
  - Anticipated launch vehicle performance class
  - Proven flight heritage
- b. Describe the types of capabilities and cost benefits the proposed spacecraft bus provides for the servicing mission
- c. Confirm the status and availability of the spacecraft bus
- d. Confirm your authority to utilize the spacecraft bus
- e. Confirm your ability to meet the delivery schedule outlined in this RFQ for a potential servicing mission
- f. Provide a top-level description of expected modifications required to perform the mission, in particular highlight any particularly critical or challenging areas

- g. Describe your approach for addressing the tasks in the SOW within the 100-day period of performance, including complying with the study requirements described in Section 3.0 above. In particular, address your approach to the SOW tasks that present the most risk, and how the risks would be mitigated during the study.
- h. Demonstrate an understanding and flight experience in the design, fabrication, integration and testing of the spacecraft bus:
  - Discuss your company's proven in-space capabilities and experience; provide information from prior or current efforts that demonstrates this capability and experience.
  - Describe your company's spacecraft quality control and product assurance processes

## **5.0 General Instructions for Study RFQ Response**

Responses to the RFQ shall:

- 1) Not exceed 40 pages including images and appendices, and not use a font size for the text smaller than 12 point.
- 2) Be specific about the spacecraft bus being proposed and its capabilities
- 3) Address all requirements noted in Sections 3.0 through 6.0 of this document.
- 4) Identify any other ideas and related activities, which your company is or has been involved with, and the significance of that activity to the servicing mission.

## **6.0 Selection Criteria for Awarding Study Opportunity**

The following are the selection criteria for the studies:

- 1) Spacecraft bus capabilities, availability, and authority for use. The offerors will be evaluated on their responses to items specified in Section 4.0, items (a) through (h).
- 2) Ability to meet the schedule described in Section 1.0 for a potential servicing mission. In addition, the expected level of modifications needed to the spacecraft bus in order to fulfill the requirements of a potential servicing mission will be evaluated for realism and reasonableness.
- 3) Completeness and reasonableness of approach for satisfying the requirements during the study period of performance, specifically in the areas identified as presenting the greatest risk and how those risks will be mitigated. The proposal must provide an approach that addresses all of the tasks to be performed and the deliverables to be provided during the study.
- 4) Proven in-space capability and experience
  - The offerors' past performance will be evaluated based upon the missions supported and the specific work done in the following areas of complex satellite systems: design, development, integration & test (especially payload integration to a bus), and operation. In addition, recent relevant capabilities and experience that support your ability to build/deliver a highly reliable satellite to orbit on-time will be evaluated.
- 5) Compliance with the model terms and conditions, including the \$150K limit on study funding as well as data rights for delivered study reports.

NASA GSFC reserves the option to not select any contractor under this RFQ on the basis of responses received. NASA may or may not decide to move forward with future mission planning as a result of these studies. No strategy has been finalized nor do details exist at this time for any potential hardware acquisition.

## **7.0 Acronym List**

CSR	Concept Study Report
EST	Eastern Standard Time
GSFC	Goddard Space Flight Center
LEO	Low Earth Orbit
PO	Purchase Order
POC	Point of Contact
ROM	Rough Order of Magnitude
RFQ	Request for Quote
SSCO	Satellite Servicing Capabilities Office
SOW	Statement of Work
TBC	To Be Confirmed
TBD	To Be Determined